Study of the Spin Dependent ^{3}He-Nucleus Interaction at 450MeV

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The spin dependence of the nucleus-nucleus interaction have been of special interest be- cause it closely related to the nuclear structure and reaction mechanism as well as to the spin dependence of the interaction between constituent particles. Recently, microscopic calculations based on the single-folding (SF) and the double-folding (DF) models predict the large effects of the spin-orbit component on the cross sections and analyzing powers for ^{3}He-Nucleus elastic scattering at intermediate energy [1], while such effects axe very small at low energy.

We performed the measurement of cross sections and analyzing powers of ^{3}He elastic scattering from ^{12}C, ^{58}Ni, ^{90}Zr at T_{3He} = 450MeV. Analyzing powers were measured by the double scattering method. Calorie meter which consists of the plastic scintillator's was installed to measure the energy of the secondary scattered ^{3}He by the analyzer target.

At first we calibrated the FPP system using the absolute value of the polarization for ^{3}He+^{12}C elastic scattering at $\theta_{lab} = 7^o$, where DF-model calculation predict the maximum value of the polarization. Preliminary value of the polarization and the effective analyzing power axe p=0.540±0.035 and $< A_y >$=0.172±0.026, respectively.

Fig. I shows the preliminary result of the angular distribution of the cross sections and analyzing powers for the ^{3}He elastic scattering off ^{58}Ni nuclei. The experimental results shows the large values of the polarizations at the angles of local minimum values of the cross sections. Solid line shows the phenomenological optical model calculations with central and spin-orbit potentials. Each optical potential parameters are shown in the Table 1. In the parameter search the real part of the volume integral per nucleon (J'_R) and the spin-orbit radius ($r_{S.O.}$) was fixed to the value for the protons at 15OMeV and the value at the low energy (T_{3He} = 33MeV), respectively. The calculation result suggests the large effect of the spin-orbit potential to the analyzing powers.

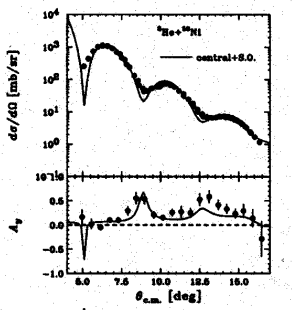

Fig. 1: $\frac{d\sigma}{d\Omega}$ and A_y for ^{3}He+^{58}Ni with phenomenological optical model.

References

[1] Y. Sakuragi and M. Katsuma, Nucl. Instr. Meth. A402, 347 (1998).